Space Weather Technical Forecast

Issued on Saturday, 08 June 2024 at 00:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Isolated M-flares remain likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate during the last 24 hours, with a M4.0 flare at 07/0913 UTC from AR3709 on the southeast limb, and a M1.2 flare at 07/1622 UTC from AR3697 in the southwest.

There are currently nine numbered visible sunspot regions. AR3697 (Fki/Beta-Gamma-Delta) in the southwest continues to show slow growth in areal extent, with a few new small spots emerging to the west which have tentatively been included with this region, extending its overall width. AR3703 (Dai/Beta) in the southwest quadrant has shown some decay, with a slight decrease in overall size and some simplification in magnetic structure. AR3707 (Dsi/Beta) in the southeast continues to show spot emergence. AR3709 (Cki/Beta-Delta) is rotating into view on the southeast limb and remains difficult to accurately assess due to foreshortening effects. However, there appears to be a possible delta magnetic configuration in the main lead spot portion. All other regions are smaller, simpler and relatively inactive at present.

There were no Earth-directed CMEs observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, were at background levels, 350-400 km/s, until around 07/1050 UTC when increasing to 450-514km/s thereafter. Density was average to below average for much of the period, but increased to moderate levels between 07/1400-1600 UTC, peak 20 ppcc. The Interplanetary Magnetic Field (IMF), Bt, was mostly weak, at 8nT or below, but became moderate for a time between 07/1055-1430 UTC, peak 15nT. The north-south component was often weakly negative (southward) until 07/1055 UTC, when it became persistently moderate negative, peak -15nT, until 07/1405 UTC. Spells of weakly positive (northward) and negative (southwards) were observed for the remainder of the period. Phi angle showed multiple switches between negative (toward the Sun) and positive (away from the Sun). The above parameters appear to indicate the arrival and passage of an un-forecast CME.

Resultant geomagnetic activity increased from Quiet to Unsettled (Kp 1-3) to G2/Moderate storm (Kp 6) levels for a time 07/1200-1800 UTC, before returning to Unsettled levels thereafter (Kp 3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 persisted at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels with the associated 24-hour fluence well below Active. Observed fluence at 08/0000 UTC was 1.45e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Further M-class flares are considered Likely, along with a Slight Chance of an X-class flare, these most probably from AR3697 or AR3707.

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Met Office Space Weather Technical Forecast

Solar Wind / Geomagnetic Activity: There are currently no Earth-directed CMEs forecast. The current slightly elevated solar winds, following the CME passage, should slowly ease on day 1 (8 June). However, there is another potential enhancement from the elongated and rather narrow CH42/+ in the northwest disc, which could bring renewed slightly elevated or possibly elevated wind speeds for a time later on day 1 (08 Jun), or perhaps more likely into day 2 (09 Jun).

Generally Quiet to Unsettled geomagnetic activity is expected on day 1 (08 June), but with the potential for some short-lived Active conditions from any coronal hole fast wind onset, and just a slight chance of isolated G1/Minor Storm. This would be most likely either late on day 1, or during day 2 (09 June). Thereafter, a return to mainly Quiet conditions is currently anticipated.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at background levels, with a slight chance of rising above the S1/Minor Radiation Storm threshold throughout given any notable flares, most likely from AR3697. High energy electron flux is forecast to persist at background to moderate levels, and the associated 24 hour fluence forecast to remain below the Active threshold, although with a rising trend possible from day 2 (09 June).

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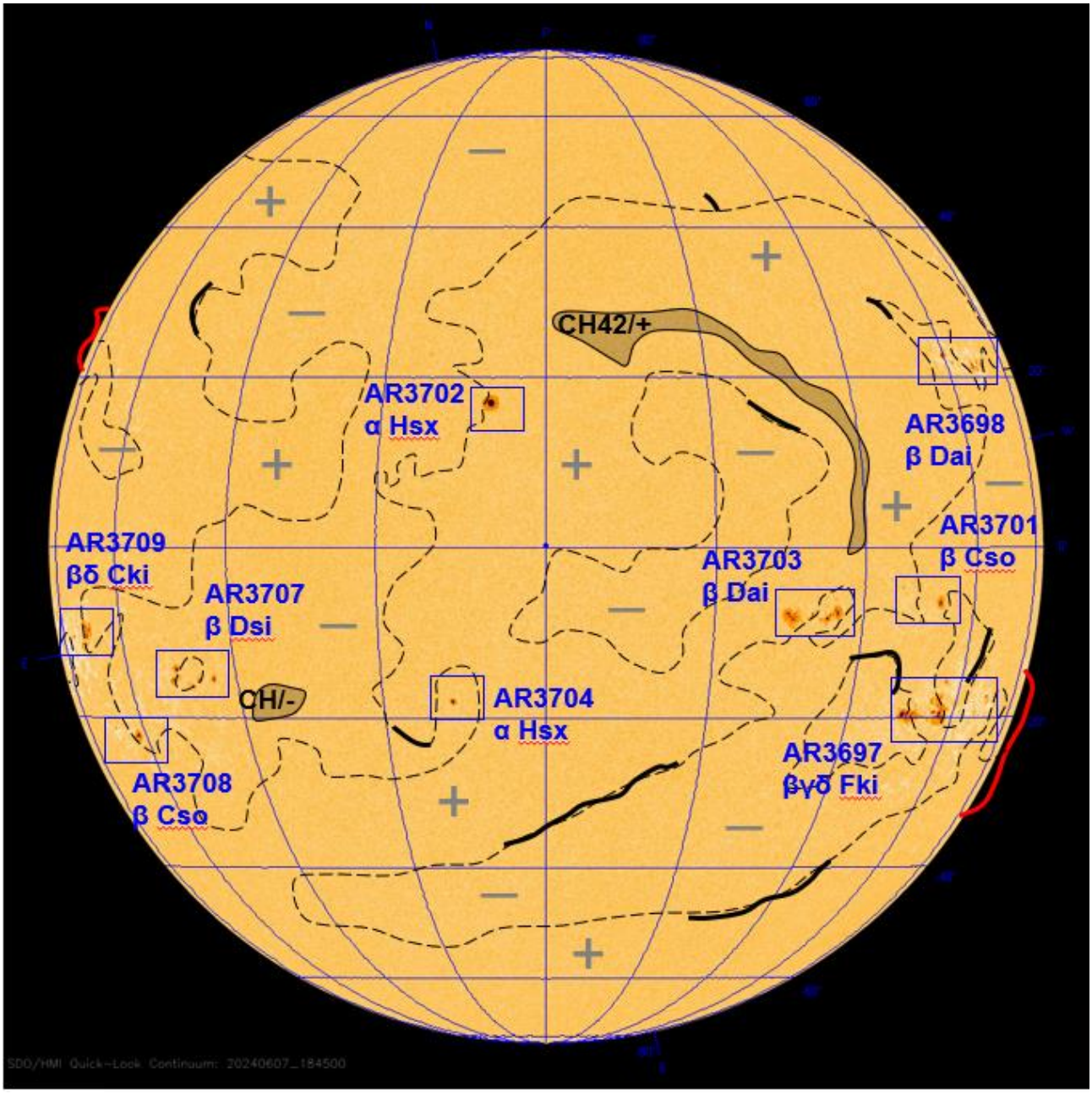
Figure 1. Solar Analysis Valid 07/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth-directed CMEs forecast.

However, an unexpected CME arrived around 07/1050 UTC, increasing geomagnetic activity from Quiet to Unsettled to G2/Moderate storm levels for a time 07/1200-1800 UTC, before returning to Quiet to Unsettled levels thereafter. Solar winds, which had been at background levels, increased 450-514km/s following this CME arrival.

The current slightly elevated solar winds, following the CME passage, should slowly ease on day 1 (8 June). However, there is another potential enhancement from the elongated and rather narrow CH42/+ in the northwest disc, which could bring renewed slightly elevated or possibly elevated wind speeds for a time later on day 1 (08 Jun), or perhaps more likely into day 2 (09 Jun). MOSWOC ENLIL model output supports some weak connection with similar timings. Comparison with imagery from last rotation shows a similar shaped coronal hole in a similar position, although better defined last time. However, solar wind from the previous rotation was dominated by the arrival of fast CMEs, so persistence will not provide a guide.

Generally Quiet to Unsettled geomagnetic activity is expected on day 1 (08 June), but with the potential for some short-lived Active conditions from any coronal hole fast wind onset, and just a slight chance of isolated G1/Minor Storm. This would be most likely either late on day 1, or during day 2 (09 June). Thereafter, a return to mainly Quiet conditions is currently anticipated.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	5	10	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

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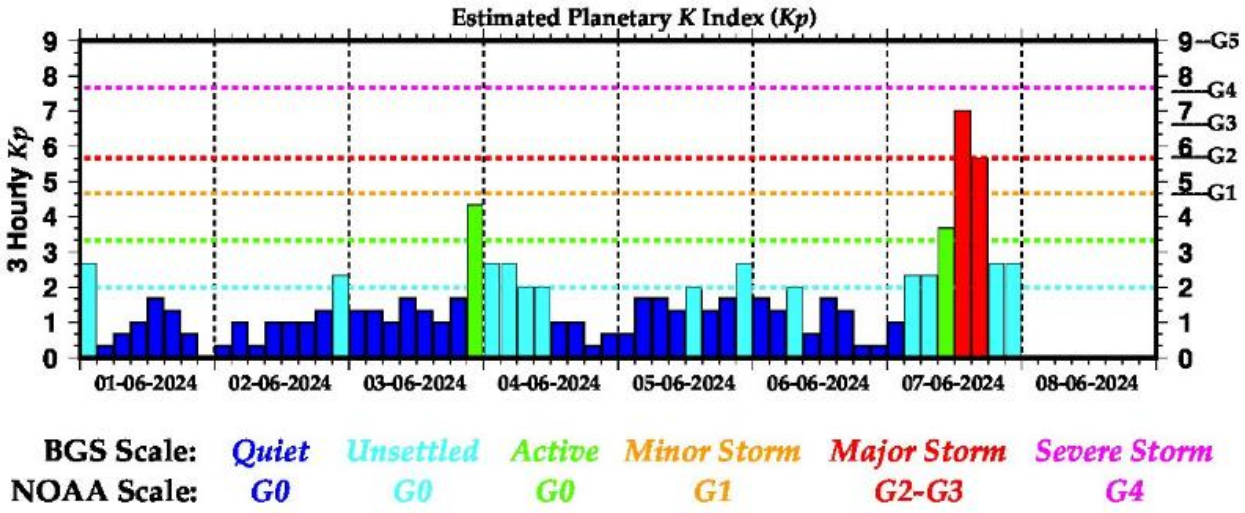
Figure 2: BGS plot of Planetary K index (Kp), showing the increased activity for a time on the 7th.



Radio Blackouts - X-Ray Flares:

Solar activity has been Moderate during the last 24 hours, with a M4.0 flare at 07/0913 UTC from AR3709 on the southeast limb, and a M1.2 flare at 07/1622 UTC from AR3697 in the southwest.

There are currently nine numbered visible sunspot regions. AR3697 (Fki/Beta-Gamma-Delta) in the southwest continues to show slow growth in areal extent, with a few new small spots emerging to the west which have tentatively been included with this region, extending its overall width. AR3703 (Dai/Beta) in the southwest quadrant has shown some decay, with a slight decrease in overall size and some simplification in magnetic structure. AR3707 (Dsi/Beta) in the southeast continues to show spot emergence. AR3709 (Cki/Beta-Delta) is rotating into view on the southeast limb and remains difficult to accurately assess due to foreshortening effects. However, there appears to be a possible delta magnetic configuration in the main lead spot portion. All other regions are smaller, simpler and relatively inactive at present.

Further M-class flares are considered Likely, along with a Slight Chance of an X-class flare, these most probably from AR3697 or AR3707.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	70	70	70	60
Very Active	R3 to R5 X Class	No	10	10	10	10

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Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background levels. There is a slight chance of proton flux exceeding the S1/Minor Radiation storm level, most likely from AR3679 as it rotates toward, then eventually around the southwest limb by the end of the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux, as observed by GOES-16, is expected to persist at mainly background levels, with diurnal moderate peaks. CH42/+ could become geoeffective during days 1 and 2 (8 and 9 June), with a possible rising trend in the second half of the period. The associated 24 hour electron fluence is expected to remain well below the Active level, although may see a rising trend following any coronal hole influence. MOSWOC REFM output is viewed as generally good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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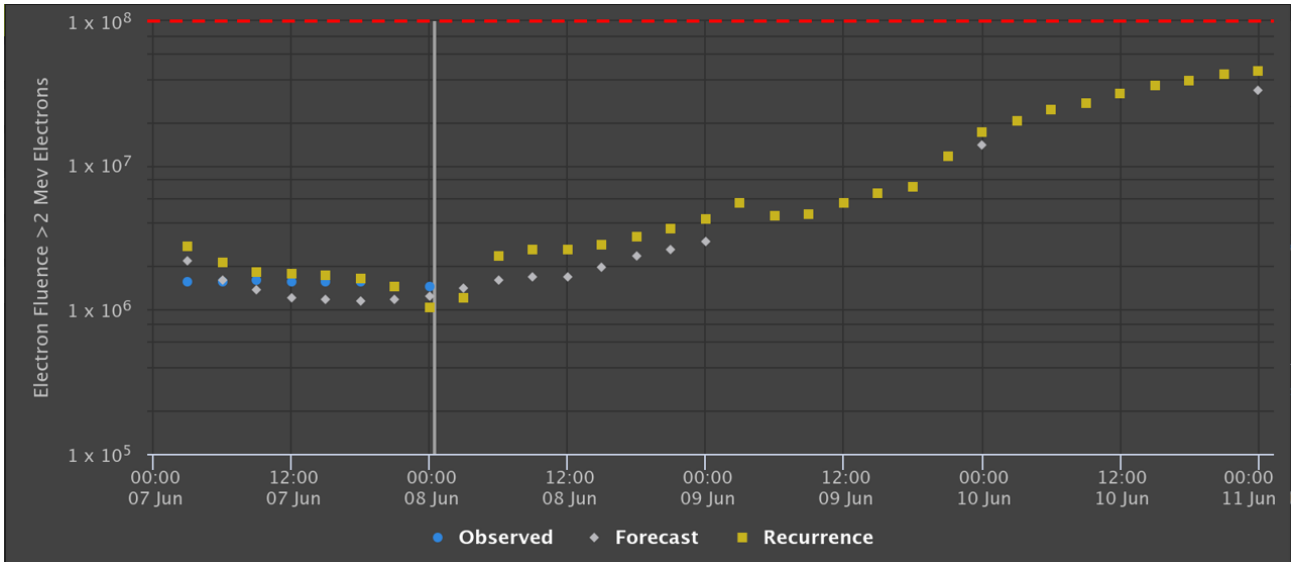
Figure 3: Latest MOSWOC REFM output.



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